

AMENDMENTS TO THE CLAIMS:

Please amend the claims as follows:

1. (Original) A device for controlling an electric motor of the electronic switching type comprising N pairs of poles and P phases, the said device comprising:
 - a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a so-called "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);
 - a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of N*M pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B).

2. (Original) A device according to Claim 1, characterised in that the angular distances separating each of the M singularities (2b1) are different from each other.

3. (Currently Amended) A device according to Claim 1 or 2, characterised in that each multipole track (2a, 2b) is formed by a magnetic ring on which there are magnetised North and South poles (2d) equally distributed with a constant angular width, a magnetic singularity (2b1) of the revolution pip track (2b) being formed by two adjacent poles (2d) whose magnetic transition is different from the others.

4. (Currently Amended) A bearing of the type comprising a fixed race (4) intended to be associated with a fixed member, a rotating race (5) intended to be rotated by the rotor (1) of the electric motor and rolling bodies (6) disposed between the

said races, the said bearing being characterised in that the coder (2) of a control device according to ~~any one of Claims 1 to 3~~ claim 1 is associated with the rotating race (5).

5. (Original) A bearing according to Claim 4, characterised in that the coder (2) is associated with the rotating race (5) so that the external face of the said coder is substantially contained in the plane P of a lateral face of the fixed race (4).

6. (Currently Amended) A bearing according to Claim 4 ~~or~~ 5, characterised in that the coder (2) is carried by an association armature (7).

7. (Original) A bearing according to any one of Claims 4 to 6, characterised in that the sensor (3) of the control device is associated with the fixed race (4) of the bearing.

8. (Currently Amended) An electronically switched motor equipped with a control device ~~according to any one of Claims 1 to 3~~ said motor including N pairs of poles and P phases, said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a so-called "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);

- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip

track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of $N \cdot M$ pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B), of the type said motor further comprising a rotor (1) mounted for rotation by means of a bearing according to Claim 7.

9. (Currently Amended) An electronically switched motor equipped with a control device ~~according to any one of Claims 1 to 3~~ said motor including N pairs of poles and P phases, said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a so-called "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);

- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of N*M pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:
- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;
- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);
- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B), ~~of the type~~ said motor further comprising a rotor (1) mounted for rotation by means of a bearing according to any one of Claims 4 to 6, the sensor (3) being associated with a fixed piece (8) of the motor.

10. (Currently Amended) An electronically switched motor equipped with a control device ~~according to any one of Claims 1 to 3~~ said motor including N pairs of poles and P phases,said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a so-called "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);
- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are

positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of N*M pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B), of the type said motor further comprising a rotor (1) and a fixed piece (8), in

which the coder (2) is associated with the rotor (1) and the sensor (3) is associated with the fixed piece (8).

11. (Currently Amended) A method for controlling a motor ~~according to any one of Claims 8 to 10~~, said motor being an electronically switched motor equipped with a control device, said motor including N pairs of poles and P phases, said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);

- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of $N \cdot M$ pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary

sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B),

said motor further comprising a rotor (1) mounted for rotation by means of a bearing comprising a fixed race (4) intended to be associated with a fixed member, a rotating race (5) intended to be rotated by the rotor (1) of the electric motor and rolling bodies (6) disposed between the said races, wherein the coder (2) is associated with the rotating race (5) and is carried by an association armature (7), and the sensor (3) is associated with the fixed race (4) of the bearing; characterised in that it comprises said method comprising the following successive steps:

- application of applying a torque to the rotor (1) so as to allow its rotation and therefore that of the coder (2);

- ~~detection of~~ detecting the first binary sequence;
- ~~determination of~~ determining the state of the switching logic corresponding to the absolute angular position associated with the said binary sequence;
- sending to the switching circuit switching signals corresponding to the state determined;
- ~~iterative determination~~ iteratively determining of the subsequent states of the switching logic from the position signals (A, B);
- sending to the switching circuit the switching signals corresponding to the states determined.

12. (Currently Amended) A method according to one of Claims 11, 13 or 14, characterised in that it comprises a prior step of angular indexing of the revolution pip pulses with respect to the zeroing of the electromotive forces in the phases of the motor.

13. (New) A method for controlling a motor, said motor being, an electronically switched motor equipped with a control device, said motor including N pairs of poles and P phases, said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);
- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are

positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of $N \cdot M$ pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

- to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B),

- said motor further comprising a rotor (1) mounted for rotation by means of a bearing comprising a fixed race (4) intended to be associated with a fixed member, a rotating race (5) intended to be rotated by the rotor (1) of the electric motor and rolling bodies (6) disposed between the said races, wherein the coder (2) is associated with the rotating race (5) so that the external face of the coder is substantially contained in the plane P of a lateral face of the fixed race (4), and the sensor (3) being associated with a fixed piece (8) of the motor;

said method comprising the following successive steps:

- applying a torque to the rotor (1) so as to allow its rotation and therefore that of the coder (2);
- detecting the first binary sequence;
- determining the state of the switching logic corresponding to the absolute angular position associated with the said binary sequence;
- sending to the switching circuit switching signals corresponding to the state determined;
- iteratively determining of the subsequent states of the switching logic from the position signals (A, B);
- sending to the switching circuit the switching signals corresponding to the states determined.

14. (New) A method for controlling a motor, said motor being, an electronically switched motor equipped with a control device, said motor including N pairs of poles and P phases, said device for controlling the motor comprising:

- a coder (2) intended to be rotated conjointly with the rotor (1) of the motor, the said coder comprising a main multipole track (2a) and a "revolution pip" multipole track (2b) which are concentric, the said tracks each comprising N identical sectors (2c) angularly distributed respectively over the entire circumference of the said tracks, the sectors (2c) of the revolution pip track (2b) each comprising M angularly distributed singularities (2b1);

- a fixed sensor (3) disposed opposite to and at an air-gap distance from the coder (2), comprising at least three sensitive elements, at least two of which are positioned opposite the main track (2a) so as to deliver two periodic electrical signals S1, S2 in quadrature and at least one of which is positioned opposite the revolution pip track (2b) so as to deliver an electrical signal S3, the sensor (3) comprising an electronic circuit able, from the signals S1, S2 and S3, to deliver two square digital position signals (A, B) in quadrature which represent the angular position of the rotor (1) and a revolution pip signal (C) in the form of $N \cdot M$ pulses per revolution of the coder (2), the M singularities (2b1) being angularly distributed so that the revolution pip signal (C) is arranged so as, in combination with the signals A and B, to define the binary sequences of angular length less than that of a sector (2c) and which represent the absolute angular position of the coder (2) on a sector (2c);

- a circuit for switching the currents in the phase windings of the motor which comprises $2 \cdot P \cdot N$ switches;

- a circuit for controlling the switching circuit which is able:

- when a binary sequence is read, to determine the state of the switching logic of the currents in the phase windings which corresponds to the absolute angular position associated with the said binary sequence;

- according to the position signals (A, B) detected, to determine continuously the state of the switching logic which is adapted to the angular position of the rotor (1);

to supply the switching signals for the switches which correspond to the state of the logic determined by the revolution pip signal (C) or by the position signals (A, B), said motor further comprising a rotor (1) and a fixed piece (8), in which the coder (2) is associated with the rotor (1) and the sensor (3) is associated with the fixed piece (8) of the motor;

said method comprising the following successive steps:

- applying a torque to the rotor (1) so as to allow its rotation and therefore that of the coder (2);

- detecting the first binary sequence;

- determining the state of the switching logic corresponding to the absolute angular position associated with the said binary sequence;

- sending to the switching circuit switching signals corresponding to the state determined;

- iteratively determining of the subsequent states of the switching logic from the position signals (A, B);

- sending to the switching circuit the switching signals corresponding to the states determined.